REMARKS

Claims 1-20 are currently pending in the application; claims 13-18 have been withdrawn from consideration in response to the Restriction Requirement mailed November 10, 2005; claims 19 and 20 are newly added with this paper. Claim 1 is independent and has been amended to clarify that the present invention is directed to a nanostructure sensor comprising a molecular nanostructure and a polymer functionalization layer on said molecular nanostructure. Claims 9 and 10 are currently amended in response to the Examiner's suggestion that the appropriate acronyms be replaced with the full recitation of the term for purposes of clarity.

Support for the amendments may be found, for example, at paragraph 21 of the specification, which states that the invention provides a nanostructure having a polymer functionalization layer, which is also referred to as a recognition layer. Additional support for the amendments may be found in the definition of the term "nanostructure" as commonly understood by those of skill in the art. Indeed, as explained below, the definition of "nanostructure," as articulated in the PTO's classification definition for the term, means "an atomic, molecular, or macromolecular structure that (a) has at least one physical dimension of approximately 1-100 nanometers; and (b) possesses a special property, provides a special function, or produces a special effect that is uniquely attributable to the structure's nanoscale physical size." (*See*, Class 977, Nanotechnology, Section I Class Definition.)

Support for newly added claim 19 may be found, for example, at page 8, lines 21-24 of the Specification, which recites a partial list of nanostructures that may be used in the practice of the invention. Support for newly added claim 20 may be found, for example, at page 4, lines 6-11 of the Specification, which recites certain properties of the claimed polymer functionalization layer.

Accordingly, no new matter is added by these amendments.

Objections to the Drawings

In response to the Examiner's objection to the Drawings, Applicants herewith submit replacement drawings in compliance with 37 CFR 1.121(d).

Objections to the Claims

The Examiner has objected to claims 9 and 10 because those claims recite an acronym. In response to the Examiner's suggestion, Applicants have amended the claims to provide the full name of the acronym.

In addition, the Examiner has objected to claim 1 alleging that the term "nanostructure" is a relative term which renders the claim indefinite. Applicants respectfully disagree because the term "nanostructure" has a definition that is well known to those of skill in the art. Indeed, the term "nanostructure" has its own definition within the United States Patent Classification ("USPC") system. Specifically, the USPC defines "nanostructure" to mean "an atomic, molecular, or macromolecular structure that (a) has at least one physical dimension of approximately 1-100 nanometers; and (b) possesses a special property, provides a special function, or produces a special effect that is uniquely attributable to the structure's nanoscale physical size." (*See*, Class 977, Nanotechnology, Section I Class Definition.)

Accordingly, Applicants contend that this definition, which is well known to those of skill in the art and the Patent Office, provides sufficient meaning to the term such that one of ordinary skill in the art would understand the metes and bounds of the claimed invention.

Rejections Under 35 U.S.C. § 102 in view of Gardner

The Examiner has rejected claims 1, 4, 6, 8, 11, and 12 as allegedly anticipated by Gardner (USPN 6,111,280). Applicants respectfully traverse this rejection. Figure 1A in Gardner depicts a MOSFET heater 6, which is a complex **mechanical** structure comprising distinct elements 4, 7, 8, 9, 11 and portions of elements 3, 5, 12, and 14.

Thus, the MOSFET heater 6 disclosed in Gardner is not a "nanostructure" according to the definitions understood by those of skill in the art and the USPC. Indeed, claim 1 was amended to clarify that the nanostructure of the present invention is a **molecular** nanostructure. As such, a molecular nanostructure (*i.e.*, a nano-scaled structure formed of atoms linked by molecular bonds) of the type presently claimed is distinct from the conventional, micro-mechanical assembly taught by Gardner in the form of the MOSFET heater 6.

With respect to claims 4, Gardner does not disclose, teach or suggest electrodes in electrical communication with the molecular nanostructures, as that term is understood and defined above. Nor does Gardner disclose, teach or suggest a nanostructure comprising a gate electrode (claim 11) or further comprising passivation material covering regions in which there is electrical communication between two conduction elements and the nanostructure (claim 12), as that term is understood and defined above.

With respect to claim 6, Gardner does not disclose, teach or suggest a polymer layer on a nanostructure, as that term is understood and defined above. Indeed, Gardner at column 5, lines 22-30 states:

> Alternatively the sensor may be formed by a MOSFET having a gate formed by the gas-sensitive layer and a thin gate oxide, as described more fully below. In this case, **the gas-sensitive layer may be made of organic material, such as a conductive polymer**, or inorganic conductive material, such as a metal oxide. When gas reacts with the gas-sensitive layer, the work function of the gas-sensitive layer changer, thereby modifying the threshold voltage and the transfer and output characteristics of the MOSFET. (emphasis added.)

Indeed, as defined in the USPC, nanostructures are known to possess special properties, functions and effects that are uniquely attributable to the structure's nanoscale physical size, which are not disclosed, taught or suggested by the polymer

described in Gardner. Similarly, Gardner fails to disclose, teach or suggest a nanostructure sensor wherein the polymer layer comprises more than one material (claim 8).

Rejections Under 35 U.S.C. § 102 in view of Ng

The Examiner has rejected claims 1, 2, 4-7 and 12 as allegedly anticipated by Ng ("Flexible Carbon Nanotube Membrane Sensory System: A Generic Platform"). Applicants respectfully traverse this rejection. Indeed, claim 1 has been amended to clarify that the nanostructure includes a "polymer functionalization layer."

Ng, in contrast, at pages 367-377, describes a polymer layer comprising a polydimethylsiloxane ("PDMS") spacer or a PDMS substrate. Such polymer layers cannot be considered polymer "functionalization" layer, as described, for example, at page 4, lines 6-11 of the Specification, which states that the polymer functionalization layer of the present invention changes the electronic properties of the nanostructure. This characteristic is not described, taught or suggested by the PDMA spacer or substrate in Ng.

With respect to claims 2, 4, 5 and 7, the nanostructures described by Ng do not comport with the nanostructures as claimed, described and defined above.

With respect to claim 6, the Examiner alleges that Ng discloses a nanostructure sensor wherein the polymer layer is selected to interact with the target species. Applicants contend that Ng fails to describe the effect of a polymer layer as providing sensitivity through interaction with a target species. Indeed, Ng does not disclose, teach or suggest functionalization of the MWNTs to alter their electronic properties. The text cited by the Examiner (abstract, page 375) simply discusses certain "proof of concept" experiments that were conducted, but Ng does not describe treating the MWNTs with any material designed to improve sensitivity.

With respect to claim 12, the Examiner alleged that Ng teaches a nanostructure comprising a passivation material covering regions in which there is electrical

communication between the at least two conduction elements and the at least one nanostructure. Applicants contend that Ng fails to disclose, teach or suggest the placement of "passivation material covering regions in which there is electrical communication between the at least two conduction elements." Indeed, in Step A of Ng, the PDMS slab serves as a supporting substrate, with no other function described. Moreover, Ng does not disclose, teach or suggest the placement of any material for passivation purposes.

Rejections Under 35 U.S.C. § 103 in view of Ng

Claim 3 was rejected as allegedly obvious in light of Ng. Applicants respectfully traverse the Examiner's assertion that Ng discloses all the limitations of the nanostructure sensor. Indeed, claim 1, as amended to clarify that the sensor comprises a polymer functionalization layer, is not disclosed, taught or suggested by Ng.

Claim 8 was rejected as allegedly obvious in light of Ng in view of Buckley (USP 5,674,752). Applicants respectfully traverse this rejection. Specifically, Applicants contend that Buckley fails to disclose, teach or suggest in any form a sensor comprising nanostructures. Indeed, considering the scale comparison in Figure 2 of Buckley, the disclosed fibers appear to have a diameter of 20 microns, *i.e.*, $2x10^4$ nanometers. Moreover, Buckley describes a fabric comprising a conventional weave of insulating fibers. Indeed, the chemical sensors disclosed in Buckley employ certain fibers of a fabric of an article of clothing as a mechanical support of the "fabric chemical sensors," which comprise layers of conductive polymers - as opposed to nanostructures - as active elements. Finally, Buckley lacks any disclosure, teaching or support for electrical communication with the insulating fibers. Accordingly, Applicants believe that not only is there no motivation to combine the teachings of Ng and Buckley, but even if those references were combined, they do not reach the presently claimed invention. Thus, the rejection should properly be removed.

Claim 9 was rejected as allegedly obvious in light of Ng in view of Buckley. Applicants respectfully traverse this rejection. As noted in the USPC definition of

nanotechnology, nanostructures are known to possess special properties, functions or effects that are "uniquely attributable to the structure's nanoscale physical size." For example, Ng notes the "quantum wire" properties of SWCNTs, among other attributes (*See*, Ng, page 375, paragraphs 1-2.) Accordingly, Applicants contend that the macro-scale practices in the industrial field of sensors do not teach or suggest the novel properties of nanostructures used as sensor elements, regardless of whether those nanostructures are functionalized. Thus, even if there were motivation to combine the teachings of Ng and Buckley (which there is not), combination of the two references would not disclose, teach or suggest the presently claimed nanostructure sensor.

Claim 10 was rejected as allegedly obvious over Ng in view of McGill (USP 6,320,295). Applicants respectfully traverse this rejection. As describe above, Ng does not teach the use of PEI for any purpose. Moreover, McGill discloses making piezoelectrically-driven acoustic wave sensors having a smooth planar, active insulating surface on the order of 4 cm^2. (*See*, col. 7, lines 28-32.) The sensors disclosed in McGill are not nanostructures. In fact, the "chemoselective films" of McGill are described as simply having a mass effect on the resonant frequency of vibration of the underlying material. Accordingly, there is no suggestion in McGill of "electrical communication" with "conducting elements" because the SAW sensor of McGill does not use detection of electrical properties of either the "chemoselective films" or its underlying material. Thus, Applicants contend that because McGill fails to teach or suggest use of the cited materials as functionalization-associated nanostructures in a device having conductors in electrical communication with a nanostructure and, furthermore, does not teach the suitability of such materials as a functionalization layer in a sensor as disclosed in claim 10, the combination of Ng and McGill cannot be said to render claim 10 obvious, even if there were a suggestion or motivation to combine Ng and McGill, which there is not.

Claim 11 was rejected as allegedly obvious over Ng in view of Lieber (USSN 10/020,004). Applicants respectfully traverse this rejection. As discussed above, Ng does disclose, teach or suggest the molecular nanostructure, as that term is understood

by those of skill in the art and the USPC. Moreover, Lieber fails to disclose, teach or suggest the use of a gate electrode to influence the response of a polymer functionalization layer. Thus, not only is there no motivation to combine the teachings of Ng and Lieber, but even if there were sufficient motivation (which there is not), the combined teachings do not reach the presently claimed nanostructure sensor. Accordingly, the rejection should be removed.

Conclusion

For all the foregoing reasons, Applicants assert the claims are in condition for allowance. Favorable action on the merits of the claims is therefore earnestly solicited. If any issues remain, the Examiners is invited to contact Applicant's undersigned representative at (949) 760-9600. The Commissioner is hereby authorized to charge any additional fees that may be required to Deposit Account No. **50-2862**.

Respectfully submitted,
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